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Socio-economic disparities in the consumption of vegetables, fruit and energy-dense foods: the role of motive priorities

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Abstract

Objective: A low socio-economic status (SES) is related to less healthy dietary habits, but the reasons for this remain unclear. We examined whether the absolute or relative importance of various food choice motives contributed to SES disparities in vegetable/fruit and energy-dense food intake.

Design: We analysed cross-sectional data from the FINRISK Study 2007 by means of structural equation modelling and used a shortened version of the Food Choice Questionnaire to assess the absolute importance of health, pleasure, convenience, price, familiarity and ethicality motives. We calculated the relative importance of each motive by dividing the participant's rating of it by his/her mean score on all motives. Dietary intake was measured with an FFQ.

Setting: A population-based survey in Finland.

Subjects: Men (n 1691) and women (n 2059) aged 25–64 years.

Results: Higher education and income were related to a greater vegetable/fruit intake ($\beta = 0{\cdot}12$, $P < 0{\cdot}001$), while education was associated negatively with the consumption of energy-dense foods ($\beta = -0{\cdot}09$, $P < 0{\cdot}001$). Socio-economically disadvantaged individuals considered price and/or familiarity more important in their food choices in both absolute and relative terms. A higher income was related to a greater relative importance of health considerations. Relative motives were more strongly associated with vegetable/fruit and energy-dense food consumption than absolute motives and the relative importance of price, familiarity and health partly mediated the effects of the SES indicators on the consumption of these food items.

Conclusions: Individual priorities in food choice motives, rather than the absolute importance of single motives, play a role in producing SES disparities in diet.

Keywords
Food choice motives
Socio-economic
Diet
FFQ

Numerous studies have shown that socio-economically disadvantaged individuals have less healthy dietary habits[1,2], which may contribute to a higher prevalence of obesity and consequently diet-related chronic diseases[3]. Individuals with a lower socio-economic status (SES) tend to consume energy-dense foods more frequently, including energy-dense takeaway options, fatty meats and fried foods[2,4–7], compared with their higher socio-economic counterparts who consume more fruit and vegetables[1,2]. However, the mechanisms explaining the SES inequalities in dietary intake are not fully understood. Food choice is a complex process and various individual, social and environmental factors are likely to contribute to socio-economic inequalities in food intakes. It has been proposed that motives underlying food selection play a role in explaining SES variations in diet, but few studies have tested this empirically[8–10].

Previous research conducted in Europe and the USA has revealed that the most important food choice motives among adults are taste, health, price, and convenience of purchasing and preparation[11–13]. There is evidence that individuals with a low income or education place more importance on price and less importance on health in their food selection compared with their more educated or affluent counterparts[9,14,15]. Education may make individuals better able to process nutrition-related information and may socialize them to adopting healthy dietary habits. Furthermore, it has been shown that the cost of food is related to its nutritional quality, with lower priced products being nutritionally poor and energy-dense[16]. Thus, by implication, it may be more difficult for individuals with fewer financial resources to take health aspects into account in their food purchasing decisions. Nevertheless, only one previous study has

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examined whether various health- and non-health-related motives contribute to SES disparities in food intake. That study found that a lower fibre intake among less educated individuals was partly attributable to the higher importance they placed on familiarity and sensory appeal of the food[8].

A limitation of earlier studies is that they focus only on the absolute importance of food-related motives. Conflicts between personally relevant motives are common in specific food choice situations, making it necessary for individuals to prioritize them[17,18]. Price, taste and convenience can act as barriers to buying healthy food items, for example[19]. It would therefore be pertinent to explore the relative importance of each motive. Beydoun and Wang investigated the ratio of the importance of price relative to healthiness and found that low-SES individuals considered them both equally important, whereas those with a high SES put more emphasis on healthiness[20]. The ratio also partly explained the SES disparities in energy, fat, sodium and sugar intake. The conflict between price and health considerations is not the only one that can arise in relation to food choice, however, and thus it would be relevant to examine all motives relative to each other. The research emphasis in the related area of personal values has long been on individuals' value priorities (analysed by dividing respondents' scores on a single value by their mean ratings of all values) rather than on absolute ratings[21]. A similar approach could be adopted to investigate individual priorities in food choice motives, but we are not aware of any study that has done this.

The aim of the current study was to examine whether the absolute or relative importance of various food choice motives contributed to the education and income inequalities in dietary intake in a population-based sample of Finnish men and women. With respect to dietary intake, the focus was on the consumption of vegetables/fruit and energy-dense foods because (i) SES disparities are most consistently observed in the consumption of vegetables/fruit[1] and (ii) energy-dense food items represent less healthy options that are typically affordable and purchased as pre-prepared food.

Methods

Participants and setting

The participants of the current study took part in two phases of the National Cardiovascular Risk Factor Survey (the FINRISK Study) conducted in 2007[22]. The ethical committee of the National Institute for Health and Welfare and the hospital districts gave their approval of the study protocols, and all participants gave their informed consent. For the FINRISK Study 2007, a random sample of 10 000 people aged 25–74 years was drawn from the Finnish population register (representing all Finnish residents) in five geographic areas. The sample was stratified by gender, 10-year age groups and area. The first study phase took place from January to March 2007 and involved a total of 6258 individuals (a response rate of 63 %). The participants received by mail an invitation to undergo a health examination, together with a self-administered health questionnaire that yielded information on sociodemographic factors, health behaviour, and medical and disease history. They filled in the questionnaire at home and brought it with them when they came to the health centre for the examination.

All of the individuals who participated in the first study phase (n 6258) were invited to continue in the second phase conducted from April to June 2007, the aim of which was to investigate the dietary, lifestyle and genetic determinants of obesity and metabolic syndrome (the DILGOM sub-study). The response rate for this phase was 80 % (2325 men and 2699 women). It comprised a further health examination at the health centre during which research nurses measured the weight and height of the participants and the participants completed a 132-item FFQ and questionnaires covering psychosocial (e.g. food choice motives) and lifestyle (e.g. physical activity) factors.

The sample for the present study consisted of all 25–64-year-old men (n 1691) and women (n 2059; i.e. working-age population) who participated in both study phases. Information on sociodemographic factors (years of education, gross household income, marital status and presence of children in the household) was derived from the first phase, whereas information related to other variables (food choice motives, dietary intake, weight, height and physical activity) was based on the second phase.

Measures

Food choice motives

Food choice motives were measured with a shortened version of the Food Choice Questionnaire (FCQ)[11]. The original FCQ includes thirty-six items and is intended to measure nine different motivational dimensions underlying the selection of food (health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity and ethical concern). Respondents are asked to endorse the statement 'It is important to me that the food I eat on a typical day…' for each item, on a four-point scale (ranging from 1 = not at all important to 4 = very important). However, the factor structure of the FCQ has not been well replicated in other studies[23,24], and Fotopoulos *et al.* suggest reducing the number of motivational dimensions and using fewer items to measure each one[24]. We excluded thirteen items that had content overlap with other items, and added three items measuring ethical/political aspects of food purchasing (items 20, 22 and 26 in Appendix), which are currently relevant in the Finnish context. Confirmatory factor analysis implied that the original nine-factor structure had a poor

fit with the data ($\chi^2 = 3781{\cdot}08$, df = 265, $P < 0{\cdot}001$; CFI (comparative fit index) = 0·89; TLI (Tucker–Lewis index) = 0·87; RMSEA (root mean square error of approximation) = 0·06; SRMR (standardized root mean square residual) = 0·06) according to cut-off points suggested by Hu and Bentler[25]. A series of exploratory factor analyses (maximum likelihood extraction with oblimin with Kaiser normalization oblique rotation) clearly supported the four-factor structure (the scree plot[26] indicated that adding a fifth or more factors would not significantly increase the total variance explained in the items). These four factors were interpreted as health, pleasure, convenience and ethicality (Appendix). Three items did not clearly load on any of the factors (all loadings <0·35). We excluded one of them ('is high in protein') from the present analyses and analysed the other two as separate variables because they were the only items measuring the familiarity ('is what I usually eat') and price ('is cheap') dimensions of the original FCQ. All in all, we measured the health dimension on eight items, convenience on three items, pleasure on five items, ethicality on seven items and both familiarity and price on one item.

We derived the absolute importance of health, pleasure, convenience and ethicality by calculating the mean score of the items belonging to the respective factors, whereas the participant's rating of price and familiarity reflected the absolute importance of these two motives. We computed the relative importance of each motive by dividing the participant's absolute rating of it by his/her mean score on all twenty-five motive items. The same method has been used to calculate individuals' value priorities in studies on personal values[27,28].

Consumption of vegetables/fruit and energy-dense foods

Vegetable/fruit and energy-dense food consumption was assessed with the validated FFQ, which inquires into the average use frequencies of 132 food items common in the current Finnish diet during the previous 12 months[29,30]. There are nine possible frequency categories for all of the items, ranging from never or seldom to more than six times a day. The portion size was fixed for each one and if possible specified in natural units (e.g. glass, slice). The average intakes of fresh vegetables/fruit (sixteen items, potatoes were not included) and energy-dense foods (eight items including savoury pasties, pizza, hamburgers, fried potatoes, sausages and mayonnaise salads) were the food consumption variables of interest in the present analyses. We used the Finnish national food composition database (Fineli) of the National Institute for Health and Welfare to calculate the average daily consumption of vegetables (g), fruit (g) and energy-dense foods (g) and total energy intake (kJ) from the FFQ[31].

Sociodemographic factors

Self-reported total years of schooling were used to measure education on a continuous scale. Participants were asked to report their previous year's gross household income on a nine-point scale ranging from less than €10 000 to more than €80 000. Household income was subsequently divided by the weighted sum of the number of household adult and child members (a weight of 1·0 was given for the first adult of the household, 0·7 for all other adults and 0·5 for children under the age of 17 years), as recommended by the Organisation for Economic Co-operation and Development[32].

Age, marital status, having children in the household, BMI and physical activity were included as covariates in the analyses. Age was used as a continuous variable and marital status was dichotomized into married/cohabiting *v.* single. Households were categorized into those with children under the age of 17 years and those without children. BMI was calculated as weight in kilograms (measured to the nearest 100 g in light clothing without shoes) divided by the square of height in metres (measured to the nearest 0·5 cm). Two questions derived from the validated short form of the International Physical Activity Questionnaire (IPAQ)[33] were used to assess the number of days during the previous week on which the participants engaged in vigorous (e.g. running or lifting heavy weights) or moderate (e.g. light jogging) physical activity for at least 10 min.

Statistical methods

We analysed the bivariate associations between the study variables by means of age-adjusted partial Pearson's correlations using the SPSS statistical software package version 15·0. The next stage was to test the hypothesized mediation model between SES, food choice motives and dietary intake (Fig. 1) by means of structural equation modelling and using Mplus statistical software version 6·0[34]. We estimated the mediation model separately for all SES indicators (education and income), the food choice motives (absolute and relative) and the food consumption variables (intake of vegetables/fruit and energy-dense foods). The models were adjusted for gender, age, marital status, having children in the household, BMI, physical activity and total energy intake. However in order to avoid over-adjustment, we did not adjust the analyses of energy-dense foods for energy intake because such foods have high energy content by definition. We used Mplus[34] to derive the total, direct and indirect (through each absolute and relative food choice motive) effects of the SES indicators on the food consumption variables and their respective standard errors (see Fig. 1). Maximum likelihood robust (MLR) was used as an estimation method given that the distributions of the study variables deviated from normality to some extent. MLR produces standard errors (by means of a sandwich estimator) and a χ^2 test statistic that are robust for non-normality[34]. We did not evaluate the model fit because the estimated mediation models had zero degrees of freedom and thus, by definition, fitted the data perfectly.

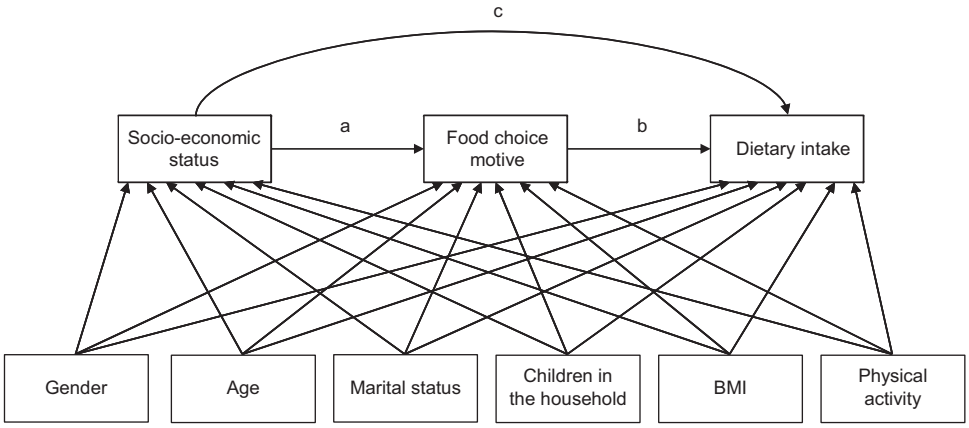

Fig. 1 The mediation model used to estimate the effects of socio-economic indicators on dietary intake. The model was estimated separately for each socio-economic indicator (education and income), absolute and relative food choice motive and food consumption variable (vegetables/fruit and energy-dense foods). All models were adjusted for age, gender, marital status, children in the household, BMI and physical activity. The models for vegetables/fruit were also adjusted for total energy intake. Rectangles represent the measured variables and arrows the regression paths between the variables. a = Direct effect of socio-economic indicator on food choice motive; b = direct effect of food choice motive on dietary intake; c = direct effect of socio-economic indicator on dietary intake; a × b = indirect effect of the socio-economic indicator on dietary intake through the food choice motive. Total effect of the socio-economic indicator on dietary intake = direct effect c + indirect effect a × b

The correlations and descriptive characteristics of the study sample are shown by gender because men and women differ considerably with respect to dietary intake and motives for food choices[11,35]. However, we carried out multi-group analyses in order to formally test gender differences related to the mediation models: the χ^2 statistic of the constrained models (the regression paths a, b and c shown in Fig. 1 were forced to be similar between genders) was compared with that of the unconstrained models (the three paths were allowed to vary freely) using χ^2 difference tests (taking into account the MLR scaling-correction factor). If the χ^2 statistic of the constrained model was significantly different from that of the unconstrained model, the gender-stratified total, direct and indirect effects are shown. We used an α level of $P < 0{\cdot}01$ instead of $P < 0{\cdot}05$, given the sensitivity of the χ^2 difference test to sample size that makes small differences statistically significant in large samples[36].

Results

Table 1 presents the descriptive characteristics of the study sample. Both men and women rated health and pleasure as the two most important food choice motives, followed by convenience and price, irrespective of whether absolute or relative motives were analysed. Women placed more importance on health, pleasure, ethicality, convenience and price in their daily food choice than men, whereas men scored more highly on familiarity (Table 1). In contrast, health and familiarity were the only relative motives showing significant gender differences.

All six absolute food choice motives correlated positively with each other, the strongest correlation being between health and ethicality ($r = 0{\cdot}55$ in men and $r = 0{\cdot}48$ in women; Table 2). When the relative importance of the motives was analysed, the associations changed substantially in both genders: health, pleasure and ethicality correlated negatively with almost all of the other motives, whereas convenience, familiarity and price were positively related. However, each relative motive had a positive and high correlation with its absolute counterpart, ranging from 0·67 to 0·87 among men and from 0·60 to 0·92 among women.

As the age-adjusted correlation coefficients in Table 3 show, participants with a higher education and income rated price and familiarity as less important in both absolute and relative terms. A minor gender difference was observed here: the relationship between education and price was significant only among women. A higher income was related to the greater relative importance of health considerations in food selection. On the relative level, all of the motives were significantly associated with the food consumption variables: pleasure, convenience, price and familiarity were associated with a lower consumption of vegetables/fruit and a higher consumption of energy-dense foods, whereas the opposite was the case with health and ethicality (Table 3). On the absolute level, all of the motives except health and ethicality correlated weakly with vegetable/fruit and energy-dense food intake ($r \leq |0{\cdot}10|$).

Tables 4 and 5 show the standardized total, direct and indirect effects of respectively education and income on vegetable/fruit and energy-dense food intake from the mediation models. Education (total effect $\beta = 0{\cdot}12$, $P < 0{\cdot}001$) and income (total effect $\beta = 0{\cdot}12$, $P < 0{\cdot}001$) were related to a higher consumption of vegetables/fruit, whereas education had an inverse association with energy-dense food intake (total effect $\beta = -0{\cdot}09$,

Table 1 Characteristics of the study participants by gender: sub-sample of men and women aged 25–64 years, FINRISK Study 2007

	Men (*n* 1616–1691)		Women (*n* 1946–2059)	
	Mean or %	SD	Mean or %	SD
Age (years)	47·6*	10·8	46·6	11·1
Education (years)	13·0*	3·7	13·8	3·7
Household income (€)	26 133·4*	14 468·7	25 057·9	13 391·3
Married (%)	74·7	–	72·3	–
Children in the household (%)	32·7	–	35·4	–
Physical activity (times/week)	4·3*	3·6	3·7	3·1
BMI (kg/m^2)	27·0*	4·3	26·4	5·4
Vegetables/fruit (g/d)	338·6*	258·1	485·5	321·5
Energy-dense foods (g/d)	122·4*	87·6	66·7	51·5
Total energy intake (kJ/d)	11 566·8*	3854·9	9338·1	3087·7
Absolute food choice motives†				
Health	2·82*	0·51	3·10	0·48
Pleasure	2·83*	0·51	3·03	0·52
Ethicality	2·36*	0·55	2·52	0·57
Convenience	2·62*	0·59	2·81	0·59
Familiarity	2·34*	0·68	2·26	0·75
Price	2·63*	0·71	2·79	0·70
Relative food choice motives‡				
Health	1·06*	0·12	1·09	0·11
Pleasure	1·08	0·17	1·07	0·16
Ethicality	0·89	0·14	0·88	0·14
Convenience	1·00	0·24	1·00	0·22
Familiarity	0·89*	0·26	0·80	0·25
Price	1·00	0·27	0·99	0·25

Mean values were significantly different from those of women (ANOVA): *$P < 0·05$.
†Values vary from 1 to 4.
‡Values vary from 0·27 to 2·86.

$P < 0·001$). The absolute importance of price, familiarity and ethicality significantly mediated the effects of the SES indicators on the intake of vegetables/fruit and/or energy-dense foods, but all of these indirect effects were very small in magnitude ($\beta \leq |0·010|$). The sizes of the indirect effects were larger in the models including relative motives, and health, price and familiarity partly attenuated the associations between the SES indicators and the food consumption variables. Multi-group analyses indicated significant ($P \leq 0·01$) gender differences in the associations between education, price and food consumption variables: the indirect effects of education through price (absolute and relative importance) on vegetable/fruit and energy-dense food intake were significant only among women (Table 4).

Discussion

The purpose of the current study was to increase understanding of the underlying reasons for SES inequalities in dietary intake. We concentrated on the role of food choice motives and, more specifically, considered whether individuals' motive priorities (i.e. relative motives) should be analysed rather than their absolute ratings of single motives (i.e. absolute motives). We identified six distinctive food choice motives, including health, pleasure, convenience, price, familiarity and ethicality. Participants with low levels of education and income placed more importance on price and familiarity of the food than their more educated and affluent counterparts in both absolute and relative terms. A minor gender difference was that education was associated with price motive (absolute and relative) only among women. Furthermore, a higher income was related to the greater relative importance of health considerations in both genders. The relative rather than the absolute importance of price, health and familiarity partly explained the SES gradient in the intake of vegetables/fruit and/or energy-dense foods.

The well-established positive relationship between SES and vegetable/fruit consumption[1,2] was replicated in the present study with respect to both educational attainment and household income. In contrast, only education showed a negative association with energy-dense food intake, which is consistent with results from a recent study on SES differences in takeaway food consumption[5]. The finding that the importance of price, familiarity and health motives varied among the SES groups supports the results of previous studies on this issue[8–10,14,15], although for the health motive we observed this only on the relative level. As expected, the relationship between income and price was the strongest of all the associations between the motives and the SES indicators. It is reasonable for individuals with fewer financial resources to emphasize price in their food purchasing decisions and there is evidence that price is a barrier to purchasing healthy food items

Table 2 Age-adjusted correlations between absolute and relative food choice motives by gender: sub-sample of men and women aged 25–64 years, FINRISK Study 2007

	Absolute motives						Relative motives					
	Health	Pleasure	Ethicality	Convenience	Price	Familiarity	Health	Pleasure	Ethicality	Convenience	Price	Familiarity
Absolute motives												
Health	1·00	0·35***	0·48***	0·10***	0·17***	0·11***	0·60***	−0·28***	0·07**	−0·38***	−0·25***	−0·21***
Pleasure	0·35***	1·00	0·30***	0·06**	0·15***	0·16***	−0·25***	0·69***	−0·07**	−0·31***	−0·17***	−0·08***
Ethicality	0·55***	0·33***	1·00	0·07**	0·10***	0·18***	−0·23***	−0·32***	0·85***	−0·39***	−0·29***	−0·12***
Convenience	0·07**	0·03	0·03	1·00	0·25***	0·30***	−0·28***	−0·24***	−0·17***	0·81***	0·08***	0·18***
Price	0·15***	0·13***	0·14***	0·32***	1·00	0·16***	−0·13***	−0·09***	0·10***	0·08**	0·86***	0·04
Familiarity	0·12***	0·18***	0·20***	0·32***	0·15***	1·00	−0·26***	−0·09***	−0·01	0·11***	−0·02	0·92***
Relative motives												
Health	0·67***	−0·20***	−0·08**	−0·28***	−0·16***	−0·24***	1·00	−0·32***	−0·33***	−0·29***	−0·14***	−0·28***
Pleasure	−0·34***	0·67***	−0·32***	−0·24***	0·13***	−0·08**	−0·39***	1·00	−0·40***	−0·17***	−0·04	−0·05*
Ethicality	0·12***	−0·04	0·83***	−0·23***	−0·06*	−0·01	−0·22***	−0·36***	1·00	−0·38***	−0·27***	−0·14***
Convenience	−0·43***	−0·34***	−0·44***	0·81***	0·12***	0·12***	−0·37***	−0·15***	−0·43***	1·00	0·22***	0·22***
Price	−0·27***	−0·18***	−0·26***	0·17***	0·86***	−0·02	−0·24***	−0·06*	−0·24***	0·28***	1·00	0·07**
Familiarity	−0·29***	−0·11***	−0·19***	0·19***	−0·00	0·87***	−0·33***	0·00	−0·18***	0·28***	0·07**	1·00

Men (*n* 1616–1686) are below and women (*n* 1946–2047) are above the diagonal.
Significance of correlation: $*P < 0·05$, $**P < 0·01$, $***P < 0·001$.

among socio-economically disadvantaged groups[37–40]. The greater importance attached to familiarity among individuals with lower levels of education and income could result in a more monotonous dietary intake. Trying new food may, for example, represent a risk of waste that less affluent individuals cannot afford to take[41]. Moreover, a higher education may increase the willingness to experiment with new foods, thereby leading to a lower appreciation of food-related traditions and familiar dietary practices[39]. The finding that considerations related to weight control and health were relatively more salient to individuals with higher incomes could, to some extent, reflect the fact that more affluent individuals have the financial freedom to take health aspects into account in their food purchasing, given the higher cost of healthy foods[16].

The present study is the first one to show that the relative importance of price, health and familiarity motives contributes to SES disparities in the consumption of vegetables/fruit and/or energy-dense foods. The mediated effects of the absolute motives were very small, however, although there were some significant indirect effects. The difference between the absolute and relative price and familiarity motives can be attributed to the fact that they were associated with a lower vegetable/fruit intake and a higher energy-dense food intake on the relative level, whereas on the absolute level their associations with these food consumption variables were weak. Similarly, a previous study (analysing motives in absolute terms) found that education groups differed in the importance they placed on four motives (price, familiarity, mood control and sensory appeal), but only familiarity contributed to the educational gradient in total fibre and fruit/vegetable intake[8]. The findings from the present study extend those obtained by Beydoun and Wang concerning the importance of price relative to healthiness as a contributor to SES disparities in diet[20] in indicating a need to analyse other food choice motives relative to each other. It should be noted, however, that the relative motives explained only part of the SES variations in dietary intake, implying that other factors are also relevant. Factors related to the food environment, such as access and availability, have recently attracted a lot of research interest and poorer access to healthy foods has been observed in socio-economically deprived areas in the USA[42]. For other high-income countries including the UK, Canada and Australia, the evidence for poorer access to healthy foods in disadvantaged areas is equivocal[42,43].

Another discrepancy between absolute and relative motives was that all of the absolute motives correlated positively with each other, in accordance with findings reported in previous studies[11,44], but convenience, familiarity and price were the only relative ones that were positively associated. The occurrence of negative as well as positive correlations on the relative level is

Table 3 Age-adjusted correlations between absolute and relative food choice motives, socio-economic indicators and food consumption variables by gender: sub-sample of men and women aged 25–64 years, FINRISK Study 2007

	Men (*n* 1616–1686)				Women (*n* 1946–2047)			
	Education	Income	Vegetables/ fruit†	Energy-dense foods†	Education	Income	Vegetables/ fruit†	Energy-dense foods†
Absolute motives								
Health	0·04	0·03	0·25***	−0·19***	−0·01	0·02	0·23***	−0·23***
Pleasure	−0·02	−0·02	0·05*	0·06*	−0·08***	−0·02	0·04	0·00
Ethicality	−0·01	−0·06*	0·15***	−0·14***	0·01	−0·05*	0·14***	−0·11***
Convenience	0·01	−0·08**	−0·06*	0·10***	0·04	0·00	−0·06*	0·08***
Price	0·01	−0·26***	−0·06*	0·02	−0·15***	−0·32***	−0·08**	0·06*
Familiarity	−0·13***	−0·11***	−0·08**	0·03	−0·19***	−0·11***	−0·01	0·07**
Relative motives								
Health	0·07**	0·14***	0·20***	−0·19***	0·04	0·10***	0·19***	−0·22***
Pleasure	−0·04	0·02	−0·09***	0·17***	−0·06**	0·03	−0·09***	0·12***
Ethicality	−0·00	−0·04	0·09***	−0·12***	0·06**	−0·03	0·09***	−0·07**
Convenience	0·00	0·04	−0·16***	0·15***	0·06*	0·03	−0·17***	0·16***
Price	−0·01	−0·24***	−0·15***	0·08**	−0·13***	−0·30***	−0·17***	0·12***
Familiarity	−0·13***	−0·08**	−0·17***	0·09**	−0·19***	−0·09***	−0·09***	0·13***

Significance of correlation: *$P<0·05$, **$P<0·01$, ***$P<0·001$.
†The food consumption variables were square-root transformed in order to improve the normality of the distributions.

Table 4 Results from the structural equation models: standardized total, direct and indirect (through food choice motives) effects of education on the consumption of vegetables/fruit and energy-dense foods among a sub-sample of men and women aged 25–64 years, FINRISK Study 2007

			Models with absolute food choice motives				Models with relative food choice motives			
	Total effect of education†		Direct effect of education		Specific indirect effects		Direct effect of education		Specific indirect effects	
	β	SE	*β*	SE	*β*	SE	*β*	SE	*β*	SE
Vegetables/fruit§ (*n* 3565)										
Health	0·12***	0·02	0·11***	0·02	0·005	0·004	0·11***	0·02	0·010**	0·004
Pleasure	0·12***	0·02	0·12***	0·02	−0·001	0·001	0·11***	0·02	0·004*	0·002
Ethicality	0·12***	0·02	0·11***	0·02	0·001	0·002	0·11***	0·02	0·002	0·001
Convenience	0·12***	0·02	0·12***	0·02	−0·002	0·001	0·12***	0·02	−0·006*	0·003
Price‡										
Men	0·15***	0·03	0·15***	0·03	0·000	0·002	0·14***	0·03	0·003	0·004
Women	0·09***	0·02	0·08***	0·02	0·009*	0·003	0·07**	0·02	0·019***	0·004
Familiarity	0·12***	0·02	0·11***	0·02	0·005*	0·003	0·10***	0·02	0·017***	0·003
Energy-dense foods§ (*n* 3620)										
Health	−0·09***	0·02	−0·09***	0·02	−0·004	0·004	−0·08***	0·02	−0·010**	0·004
Pleasure	−0·09***	0·02	−0·09***	0·02	−0·001	0·001	−0·08***	0·02	−0·006*	0·003
Ethicality	−0·09***	0·02	−0·09***	0·02	0·000	0·002	−0·09***	0·02	−0·002	0·002
Convenience	−0·09***	0·02	−0·09***	0·02	0·003	0·002	−0·10***	0·02	0·006*	0·003
Price‡										
Men	−0·06*	0·03	−0·06*	0·03	0·000	0·001	−0·06*	0·03	−0·002	0·002
Women	−0·14***	0·03	−0·13***	0·03	−0·004	0·004	−0·12***	0·03	−0·013**	0·004
Familiarity	−0·09***	0·02	−0·09***	0·02	−0·005	0·003	−0·08***	0·02	−0·014***	0·003

Significance of coefficient: *$P<0·05$, **$P<0·01$, ***$P<0·001$.
†Total effect = direct effect + indirect effect.
‡Gender-stratified results are shown because the multi-group analyses indicated significant ($P\leq0·01$) gender differences in the associations between education, price and the food consumption variables.
§The food consumption variables were square-root transformed in order to improve the normality of the distributions.

understandable in that each motive was divided by the individual mean ratings across all motives in order to determine its relative importance. People commonly prioritize food choice motives, given that it is rare for all personally important motives to be fully satisfied in any particular eating situation[17,18], and relative motive variables produce the prioritizing mathematically. One problem related to relative motives is that they do not capture individual differences in the level of involvement with food, some consumers being enthusiastic about every aspect of it and others being extremely uninvolved[45]. However, analysing motive priorities instead of absolute ratings of single motives may better reflect the complexity of the motive structure in that relatively unimportant motives might not affect food choices even though their absolute importance is high[46].

One of the strengths of the current study was that we used a large population-based sample incorporating

Table 5 Results from the structural equation models: standardized total, direct and indirect (through food choice motives) effects of income on the consumption of vegetables/fruit and energy-dense foods among a sub-sample of men and women aged 25–64 years, FINRISK Study 2007

			Models with absolute food choice motives				Models with relative food choice motives			
	Total effect of income†		Direct effect of income		Specific indirect effects		Direct effect of income		Specific indirect effects	
	β	SE	β	SE	β	SE	β	SE	β	SE
Vegetables/fruit‡ (*n* 3565)										
Health	0·12***	0·02	0·11***	0·02	0·005	0·004	0·10***	0·02	0·020***	0·004
Pleasure	0·12***	0·02	0·12***	0·02	0·000	0·001	0·12***	0·02	−0·003	0·002
Ethicality	0·12***	0·02	0·13***	0·02	−0·007**	0·002	0·12***	0·02	−0·003*	0·002
Convenience	0·12***	0·02	0·12***	0·02	0·000	0·001	0·12***	0·02	−0·004	0·003
Price	0·12***	0·02	0·11***	0·02	0·010*	0·005	0·09***	0·02	0·033***	0·005
Familiarity	0·12***	0·02	0·12***	0·02	0·004*	0·002	0·11***	0·02	0·009***	0·002
Energy-dense foods‡ (*n* 3620)										
Health	−0·03*	0·02	−0·03	0·02	−0·004	0·004	−0·01	0·02	−0·021***	0·004
Pleasure	−0·03*	0·02	−0·03*	0·02	−0·001	0·001	−0·04*	0·02	0·004	0·003
Ethicality	−0·04*	0·02	−0·04*	0·02	0·007**	0·002	−0·04*	0·02	0·004*	0·002
Convenience	−0·03*	0·02	−0·03*	0·02	0·000	0·002	−0·04*	0·02	0·004	0·003
Price	−0·03*	0·02	−0·03	0·02	−0·007	0·005	−0·01	0·02	−0·023***	0·005
Familiarity	−0·03*	0·02	−0·03	0·02	−0·005*	0·002	−0·03	0·02	−0·008***	0·002

Significance of coefficient: *$P<0·05$, **$P<0·01$, ***$P<0·001$.
†Total effect = direct effect + indirect effect.
‡The food consumption variables were square-root transformed in order to improve the normality of the distributions.

detailed information on sociodemographic factors, dietary habits and food choice motives in order to enhance understanding of SES inequalities in dietary intake. Applying structural equation modelling allowed us to explicitly test the direct and indirect effects among the variables of interest, and we took a novel analytical approach in terms of food choice motives. There are also limitations that should be taken into account in interpreting the results, however. The analyses were based on cross-sectional data, which does not allow for the ascertainment of causality or its direction. Nevertheless, SES is more likely to have an influence on food intake and food choice motives than vice versa. In addition, motivational factors are often considered to be determinants of behaviour rather than consequences. Assessing food consumption on a self-report FFQ allowed us to estimate longer-term intake, but all self-report dietary assessment methods are vulnerable to under- and over-reporting[47]. In order to take account of this, we adjusted the analyses for total energy intake and for several variables known to be related to reporting bias[30,48]. We measured two food choice motives, price and familiarity, on only one item ('is cheap' and 'is what I usually eat', respectively). This may not capture their nature comprehensively, but the associations were still consistent with those reported in previous studies assessing price and familiarity on more items[8,11]. The present sample was initially representative of the Finnish population, but the attrition rate was relatively high due to the demanding study protocol. Non-participant analyses conducted in the context of previous FINRISK studies have shown that non-participants are more likely to have a low SES[49] and this could have made our estimates more conservative.

Conclusions

The present results suggest that the less healthy dietary habits among individuals with a low SES are partly attributable to the higher priority they place on price and familiarity and the lower priority they give to health motives. Although differences between SES groups in the importance of food price and healthfulness have frequently been observed, the current findings imply that familiarity is another relevant motive that deserves further research. Furthermore, it is useful to analyse individuals' motive priorities rather than their absolute ratings of single motives, given that they may better reflect the complexity of the motive structure. On the practical level, reducing the price of healthy food could be an effective strategy for improving the diets of low-SES groups. A recent study conducted in real-life settings provided evidence that giving price discounts on healthier foods increased their purchasing irrespective of education or income level[50]. However, as Ni Mhurchu[51] notes, more research is needed in order to evaluate the exact effects of a range of pricing strategies on food consumption, health and inequalities.

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statistical analyses and drafted the manuscript. S.S.-L., K.S., S.M. and A.H. helped to draft the manuscript and advised on issues related to socio-economic factors, food choice motives and dietary intake. All authors were involved in the planning of the study and read and approved the final manuscript.

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Appendix

The four-factor structure of the shortened Food Choice Questionnaire

	Health	Convenience	Pleasure	Ethicality
1. Is low in fat†	0·81		−0·10	
2. Helps me control my weight†	0·78			
3. Is low in calories†	0·76			
4. Is high in fibre and roughage‡	0·66			0·16
5. Keeps me healthy‡	0·49		0·12	0·15
6. Contains a lot of vitamins and minerals‡	0·46		0·11	0·31
7. Keeps me awake/alert§	0·43		0·31	
8. Is good for my skin/teeth/hair/nails etc.‡	0·43		0·19	0·23
9. Is high in protein‡	0·30		0·15	0·21
10. Takes no time to prepare‖		0·92		−0·14
11. Is easy to prepare‖		0·80	−0·11	−0·16
12. Can be bought in shops close to where I live or work‖		0·38		0·14
13. Is cheap¶		0·30		
14. Is what I usually eat††		0·20		0·20
15. Smells nice‡‡			0·86	
16. Makes me feel good§			0·74	
17. Looks nice‡‡			0·61	
18. Tastes good‡‡			0·57	−0·12
19. Helps me cope with stress§			0·52	
20. Is organically grown				0·74
21. Is packaged in an environmentally friendly way§§				0·74
22. Carries the Fairtrade mark				0·69
23. Comes from countries I approve of politically§§				0·68
24. Contains no artificial ingredients‖‖	0·16	−0·10		0·65
25. Contains no additives‖‖	0·25			0·52
26. Is domestically produced	0·10			0·50
Cronbach's α	0·87	0·67	0·79	0·86

Total variance explained 45·1 %. Factor loadings ≥|0·10| are shown and items with factor loadings >|0·35| are considered to belong to the respective factor.
†Item is part of the weight control factor of the original Food Choice Questionnaire[11].
‡Item is part of the health factor.
§Item is part of the mood factor.
‖Item is part of the convenience factor.
¶Item is part of the price factor.
††Item is part of the familiarity factor.
‡‡Item is part of the sensory appeal factor.
§§Item is part of the ethical concern factor.
‖‖Item is part of the natural content factor.